Third Contribution to the Fauna of the Miocene Period of the United States.

BY EDWARD D. COPE.

PLATANISTIDÆ.

A more than usually complete skeleton of Tretosphys grandævus furnishes some characters, which, taken in connection with others known to exist in many others species of our Miocene dolphins, suggest that the true position of all of the latter is in or near the family above named.

In the skeleton mentioned there are preserved some twenty-four ribs, more or less completely, and the anterior segment of the sternum. No pieces can be referred as osseous hæmapophyses. The sternal piece also presents no pits for articulation with such hæmapophyses, either anteriorly or posteriorly, but rugose surfaces only. The probabilities are, therefore, that these elements were cartilaginous, a feature which Flower considers to be characteristic of the family Platanistidæ. The ribs present the same type. The *capitulum* and *tubercle* are well developed to near the posterior part of the vertebral column, where they become approximated, neither disappearing more than the other. In the Physeteridæ the *tuberculum* disappears posteriorly, while in the Delphinidæ the *capitulum* vanishes. In the Platanistidæ both remain and become united.

The cranium of Lophocetus exhibits features of the same family. The pterygoids are long, flat and extended anteriorly. The cavity which they roof is long and narrow, not short and inflated as in the Delphinidæ. The nasals and frontals are elongate as in Pontoporia.* In another cranium of uncertain reference, but probably of the same type, these elements are rather more shortened.

The species referred to this family, which are so abundant in our miocene beds, appear, so far as known, to have the cervical vertebræ all distinct, and generally much more elongate than in any recent forms. This peculiarity has been observed in Priscodelphinus atropius, and P. conradi, in Tretosphys grandævus, as well as in several smaller species of the family. The only cervical vertebræ referable to those of Ixacanthus cælospondylus are less elongate, and nearly as thin as some of those of Beluga canadensis; the reference to that species is, however, quite uncertain. Of an even more attenuated form is the cervical of Pontogeneus priscus Leidy, a Delphinoid from the tertiary of Louisiana.

The teeth of Tretosphys are known, and these show some affinity to those of Squalodon, in the striate enamel surface, and anterior and posterior edge separating the inner and outer faces. The fang is cylindric, the crown regularly conic, the two together strongly curved.

A cast of a tooth of Lophocetus calvertensis is quite similar in form to the preceding, and small for the size of the animal.

Such teeth belong, perhaps, to T. grandævus. The muzzle of a species of similar size, also from Shiloh, N. J., is very long, narrow and depressed, the intermaxillaries forming a broad obtuse elevation. The fragments of the muzzle of T. lacertosus, and those of some of the Maryland Priscodelphini indicate a similar form. Lophocetus Cope presents a somewhat similar form. This genus (Proceed. A. N. Sci., 1867, p. 146) will perhaps be found to be identical with one of the four which I have recognized through vertebral characters among the miocene Dolphins; but to which this reference is to be made is not as yet certain. When the portions of crania at present in my possession are carefully studied, this identification can no doubt be readily made.

The compressed roots of the teeth of Rhabdosteus distinguish them from those of the above genera, and constitute a point of resemblance to the existing Platanistidæ.

*A fine specimen of the cranium of this species from Montevideo is in the Museum of the Academy.

TRETOSPHYS Cope.

Proc. Acad. N. Sci., Phila., 1868, p. 186, 190.
Delphinapterus "Lesson," Cope, Proc. A. N. Sci. Phila., 1868, 189.

The species of this genus I formerly referred to Lesson's genus as above, the Beluga of Gray, as one of the few genera of existing Delphinidæ, in which the cervical vertebræ are all similarly distinct. I could find no characteristic feature by which to separate the two. I am, however, now entirely able to separate the miocene from the recent species, in respect to generic structure. The new genus is defined as follows, so far as known:

Cervical vertebræ elongate as in the seals, and all distinct. Their di- and parapophyses *all* united and embracing a small foramen for the vertebral artery.

In the existing genus the cervical vertebræ are thin and disc like, and none but the anterior one or two embrace a foramen, and that rarely. In the genus Tretosphys the structure is quite similar to that seen among the seals, and has given the species a physiognomy quite distinct from the modern dolphins. They have evidently had a well marked neck, endowed with considerable flexibility. This constitutes an approach to the Zeuglodonta, which is still more marked in the genus Priscodelphinus. In this also there is the same elongate series of cervical vertebræ, and well enclosed cervical canal.

The species of the genus may be defined briefly as follows:

I. But few and only posterior caudals with venous foramen at base of diapophysis.

a. Posterior lumbars three-sixteenths or less, longer than wide before diapophyses.

** Neural canal with obtuse epapophysial ridge.

Articular surface with incised median impression, central rugulose disc, and broad circumference with raised concentric striæ; lumbars straight and strongly keeled below; caudals short and broad; large.....T. LACERTOSUS.

Articular surface without striæ, and with a deep punctiform median impression which is below the middle; most lumbars concave below; caudals more elongate, 35 lines long in young: smaller.....T. GRANDAEVUS.

Articular face without striæ, and with punctiform impression (on caudal); caudal stouter, 24 lines long in adult; smallest.....T. GABBII.

aa. Posterior lumbars $\frac{1}{3}$ longer than width before diapophyses.

Articular face with punctiform impression, and no raised striæ; an epapophysis; caudal narrow, 39 lines long in adult.....T. URAEUS.

II. An anterior caudal with vascular foramen at base of diapophysis.

Articular face of lumbar with weak incised impression, smooth; below weakly keeled; length in adult 21 lines; the smallest species.

T. RUSCHENBERGERI.

The species which I described as *Delphinapterus tyrannus* (Proc. A. N. Sci. Phila., 1868, 189,) probably belongs to the toothless whales, and would correspond in size with the Eschrichtius pusillus. The collation of different parts of each of these species must be left for future opportunities. The vertebræ are distinguished by having the neural canal without epapophysis, the articular face with open median impression, and no striæ. The epiphysial ridges are much interrupted and slightly tuberculiform.

TRETOSPHYS LACERTOSUS, *Delphinapterus* (*Tretosphys*) *lacertosus* and *D. hawkinsii* Cope, l. c. p. 190.

This species is known by portions of two individuals from Charles Co., Maryland, of one from the mouth of the Patuxent, and of five at least from the marl pits of John Hummel, Henry Ware and others, near Shiloh, Cumberland Co., N. J. Portions of crania with teeth, etc., are mingled with the vertebræ, and furnish material for a partial analysis of the characters of the species.

TRETOSPHYS GRANDÆVUS Cope. *Delphinapterus grandævus* Cope, Proc. A. N. S. 1868, 191. *Priscodalphinus grandævus* Leidy, l. c. 18, 51, 327.

The caudals of this dolphin were the parts of it first discovered. Since then a lumbar of one, and a large part of the skeleton of another individual have been received by the Academy, all being from the same locality, Shiloh, Cumberland Co., N. J. Unfortunately the last series contained no caudal vertebræ; its reference to this species is not entirely established, though the correctness of the same is very probable.

The remains of the most perfect individual consist of seven cervical, nine dorsal, and seven lumbar vertebræ; there are twenty-four ribs and the anterior element of the sternum. The distinctive features of the vertebræ have been already given. The manubrium of the sternum is T-shaped, and is somewhat expanded posteriorly. The anterior (inferior) face is plane, (slightly concave antero-posteriorly); the margins rounded. The superior face is roof-shaped to a median keel, which disappears posteriorly.

TRETOSPHYS GABBII, *Delphinapterus gabbii* Cope, l. c. 191.

No material characteristic of this species has been found since its description.

TRETOSPHYS URÆUS Cope, sp. nov.

This species is established on a lumbar vertebra from the miocene of Shiloh, Cumberland Co., N. J., with which I have associated a caudal vertebra from near the mouth of the Patuxent, which was lent me for determination by Philip P. Tyson, State Geologist of Maryland.

The character of elongation seen in the genus Zarhachis strikes the eye at once in this species. Although not carried so far as in that genus, it exceeds considerably species of this, or of Priscodelphinus, with which we are acquainted; hence, though the material is slight, there can be no doubt that it represents an animal not previously known.

The articular face of the lumbar is not complete in all its outlines, but has evidently been as deep as wide, and perhaps nearly round. The median impression is punctiform and remarkably strong. The profile of the inferior outline is concave and is constituted by an obtuse keel, on each side of which is a short longitudinal depression. The diapophyses have been broken off, but their bases are both broad and deep, slightly filling the concavity of the infero-lateral face. Supero-lateral face strongly concave in both directions.

	Lines.
Length of centrum	39
" " basis neurapophysis	28·5
" " basis diapophysis	20
Width neural canal	4

The caudal has broad diapophyses and the band-like impression passing in front of them, and converging the centre of the median line below, a character seen in many species of the genus. The points of attachments of chevron bones are well marked; they entirely disappear on the middle portion of the centrum. The articular face is similar to that of the lumbar, but is a little broader than high. The surfaces are everywhere concave, and are not marked by any longitudinal ridges.

The same vertebræ of T. grandævus present many ridges; those of T. lacertosus are variable.

	Lines.
Total length	39
Length basis neurapophysis	25
" " diapophysis	24
Width neural canal	2·6
" articular face	25·5
Depth articular face	21·3

This is probably the second of the genus length, and the third in bulk.

[March,

TRETOSPHYS RUSCHENBERGERI, *Delphinapterus ruschenbergeri* Cope, Proc. A. N. Sci., Phila., 1868, 189.

This is the smallest of the genus. It is known only from a caudal and lumbar vertebra of one individual, from Charles Co., Maryland.

ZARHACHIS Cope.

Proc. A. N. Sci. 1868, 189.

Examination of additional material renders it necessary to correct the characters of this genus as originally given. It was stated to differ from Priscodelphinus in that, while some caudals had spinous diapophyses, others possessed them flat, but imperforate. A vertebra supposed to indicate the latter characters I am now compelled to refer to another species and probably a genus. Other vertebræ assigned to Z. flagellator, must be referred elsewhere. A lumbar vertebra represents another species of probably the same genus, while a third has evidently pertained to still a third species. The genus will be characterized by the extraordinary length and slenderness of the lumbar vertebræ, and similar, though slightly abbreviated form of the caudals. The latter have spinous diapophyses, and in one species the former also. While the width of the articular faces of the centra of these vertebræ in the typical Priscodelphinus is but few lines less than the length, in the species of this genus the diameter of the same is only from four-sevenths to one half the length. The nearest approach is made by Priscodelphinus stenus, m., where this diameter is 6-7ths of the length.

The three species of Zarhachis may be distinguished as follows:

I. Median or anterior caudal with a strong longitudinal keel above the diapophysis—which is therefore probably present on the distal lumbars.

Epiphysis thicker, larger..... Z. FLAGELLATOR.

II. No longitudinal keel on lumbars. Diapophyses broad, flat; epiphyses thin; large..... Z. TYSONII.

Diapophyses narrow, subspinous; epiphyses thin; small..... Z. VELOX.

ZARACHIS FLAGELLATOR Cope, Proceed. Acad. Nat. Sci., Phil., 1868, 189, pars.

The caudal vertebra, described as above, is the only indication which we have as yet of this large adolphin.

Miocene, Charles Co., Md.

ZARHACHIS TYSONII Cope, sp. nov.

This species is established on one posterior lumbar vertebra only, but its form is so characteristic as to render its identification a comparatively simple matter. The attenuated form characteristic of the genus is accompanied by broad diapophyses, showing that, as in Priscodelphinus, the species differ in the number of the posterior vertebræ which exhibit the contraction of the diapophyses.

The specimen preserved belonged to an adult animal. It was apparently one of the most posterior lumbars, as there are two feeble longitudinal ridges beneath, whose interval is again obtusely ridged and perforate by several foramina. The inferior outline is strongly concave in longitudinal section, and all the planes are concave in transverse section. The articular faces are a little wider than deep. The neurapophyses occupy a base of ·75 the length of the centrum. The diapophyses are about equidistant between them and the nearest inferior ridge.

	Lines.
Total length centrum	48
Transverse diameter articular face	29
Vertical " " "	27
Width neural canal (internal)	5
" between inferior ridges	8

This specimen was found at the mouth of the Patuxent River, Maryland. It is water worn, and has been probably washed from the cliffs, and been covered by the tide.

The animal to which it belonged was not less attenuated in the posterior part of the vertebral column than the great Basilosaurus.

ZARHACHIS VELOX Cope.

This species is likewise only represented by a single vertebra, which is from the lumbar series anterior to the position of that of Z. TYSONII just described. It has pertained to an adult animal of half the size of the preceding, and one which carried the narrowed subspinous diapophyses forward, though perhaps not so markedly as the Priscodelphinus s p i n o s u s, m.

The inferior outline is straight, and is the edge of a very strong thin keel, whose greater median prominence is due to the strong concavity of the inferior surfaces. The same concavity with that of the upper surface causes the existence of a strong longitudinal lateral keel, from the middle of which springs the diapophysis. The basis of the neural arch is thin and does not extend over more than ·6 the length of the centrum.

The articular faces are discoid, and if one diameter exceed another it is the vertical; they have a somewhat expanded appearance from the concavity of the sides. Surfaces smooth.

	Lines.
Length centrum	33
Transverse diameter of extremity	17
Vertical " "	17
Internal width of neural canal	3·1
Length of basis of diapophysis	8

This species was taken from the miocene marl from the pits of Reuben Ayers, near Shiloh, Cumberland Co., N. Jersey.

It indicates an even more slender and snake-like cetacean than the preceding, of much smaller size.

ESCHRICHTIUS Gray.

There is in the Thomas collection a portion of the cranium of a small Balænoid, which from its resemblance to those of the existing finner whales, its small size, locality, and black color, I attribute provisionally to the Eschrichtius p u s i l l u s. It serves to confirm the affinities expressed in the name established on the ramus of the mandible. The alisphenoids present a deep, smooth posterior excavation, as in Sibbaldius, while the infero-lateral processes of the basioccipital are stronger than in that genus. The conchs of the perotic bones are preserved; they are characterized by the possession of a hooked process turned outward, on the outer and more elevated margin.

An examination of additional material of these extinct Balænidæ, has enabled me to trace the affinities of species of which little has been hitherto known. Thus the *Balæna prisca* Leidy appears nearly affined to species referred by me to Eschrichtius through intermediate forms. Vertebræ very similar to those referred to the *Megaptera expansa* Cope are accompanied by mandibular rami of the same general type, and would be better referred to the same genus, in the absence of evidence to the contrary. It appears that there are six species of the genus, whose characters offer nothing as yet to separate them from the scarcely extinct type E. r o b u s t u s Lillj. Five of these can be characterized from the forms of their mandibular rami, and are therefore compared in the following table. The other species, E. l e p t o c e n t r u s, m., is indicated by vertebræ alone.

Much compressed, outer face little convex; superior margin a narrow ridge without any truncation, with a series of foramina on each side, the inner extending for a very short distance only; no marginal groove; inferior edge narrow. Very large ..... E. CEPHALUS.

Upper edge broad, with *outer* series of foramina, and meeting inner-edge at a right angle, which is the highest line, and with inner series of foramina just below it; most convex externally. Large ..... E. PRISCUS.

Upper edge broad behind only, and these bearing only the *inner* series of foramina. Elsewhere with a median ridge and rows of foramina below on each side; much decurved; less convex externally. Medium... E. EXPANSUS.

Upper edge nowhere broad, and with a deep or shallow groove below it on inside; less decurved, less convex externally; small..... E. PUSILLUS.

ESCHRICHTIUS LEPTOCENTRUS Cope, Proceed. Ac. N. Sci., Phil., 1867, 147.

The largest of the miocene species, the vertebræ considerably exceeding corresponding ones of the E. c e p h a l u s.

ESCHRICHTIUS CEPHALUS Cope, loc. cit. p. 148.

Indicated by a large part of the cranium and other parts of the skeleton, with flipper, etc., from Charles Co., Md., and by a portion of the mandible of a second individual from near the mouth of the Patuxent River, Md.

ESCHRICHTIUS PRISCUS Leidy. *Balæna prisca* Leidy, Pr. A. N. S. Phil., 1851, 308. *Balænoptera prisca* Cope, l. c. 1867, 144.

A portion of a mandibular ramus of this species furnishes all that we know of it. In size it is intermediate between the two here preceding and following it.

The miocene of Westmorland Co., Va.

ESCHRICHTIUS EXPANSUS Cope. *Megaptera expansa* Cope, l. c, 1868, 193.

In addition to numerous vertebræ, portions of the limbs and of three mandibular rami of two individuals have been discovered. The latter present, for a marked distance on the proximal portion, a flat plane on the upper face, instead of the usual angulate ridge, which is equally distinct from the outer and inner faces. In E. p r i s c u s the superior plane is only a continuation of the outer convex face, and accordingly the external series of nutritious foramina extends along it. The plane is occupied on the other hand, in the E. e x p a n s u s, by the inner series.

The inferior margin is a rather obtuse angle; the general form is not compressed, nor much convex externally, as in E. p r i s c u s.

	Inches.
Depth ramus	2·75
Thickness "	1·65
Foramina (internal) two in	2·50

From the mouth of the Patuxent, coll. of P. T. Tyson, State Geological Survey of Maryland.

ESCHRICHTIUS PUSILLUS Cope, Proceed. Acad. Nat. Sciences, Philada., 1868, 159, 191.

A ramus of the mandible of this species from the mouth of the Patuxent River differs from the type in having the inner groove of the superior margin much less marked; the inner face is plane, but leaves the superior groove with a marked convexity. The outer face is gently convex, and the outer foramina open externally. Slightly decurved, as well as curved longitudinally. Behind the foramina, the superior margin rises to a well marked base for a coronoid process, which is not preserved.

	Inches.	Lines.
Depth ramus	1	10·5
Thickness	1	2·5
Foramina (internal) intervals	1·	

CROCODILIA.

THECACHAMPSA Cope.

Further investigation shows that this genus is gavial-like, and that the peculiarity which characterizes its dentition also belongs to Plerodon Meyer of the European Miocene. Thoracosaurus, of the American Cretaceous, presents also the same character. Plerodon differs from the American form in

being like Crocodilus in cranial characters, while Thecachampsa is a gavial. The species of the latter are T. SERICODON Cope, abundant in New Jersey, at Shiloh and elsewhere, with long curved cylindric teeth. T. SICARIA Cope, from Maryland, with much compressed crown of the tooth, with prominent cutting edges. T. ANTIQUA (*Crocodilus* Leidy,) with teeth less curved, cylindric and with very short cutting ridges. From Virginia.

The characters of the three species may be thus compared:

The crowns of the teeth not compressed, with short cutting edges. T. antiqua.

Crowns cylindric, curved, with long and delicate cutting edges. T. sericodon.

Crowns compressed with very prominent crenulate cutting edges, on a marginal base..... T. sicaria.

The last named also possesses a large maxillary tooth, near the position of the ninth of Crocodilus, which fits a corresponding concavity between two of the mandibular teeth, resembling in this the existing genus Tomistoma.

TESTUDINATA.

TRIONYX Geoff.

TRIONYX LIMA Cope, sp. nov.

Represented by one costal-bone from Shiloh, N. Jersey. It is massive, and strongly sculptured by numerous approximated narrow raised ridges, which extend across the bone, with little inosculation, and which leave intervals between them a little wider than themselves.

The characters may be compared with those of the three species from the cretaceous of New Jersey, as follows:

Costal bone transversely figured by narrow elevated ridges..... T. lima.

Costal bone with thick, low, transverse ridges, which are connected by cross-ribs which leave series of pits..... T. priscus.

Costal bones with transverse irregular grooves proximally which remain along the sutures only distally, leaving an area of a shallow honey-comb pattern medially..... T. pennatus.

Costal bones with a shallow coarse honey-comb pattern, tending to confluence distally ..... T. halophilus.

April 6th.

The President, DR. HAYS, in the Chair.

Twenty-six members present.

The following papers were presented for publication:

Notice of some Extinct Vertebrata from Wyoming and Dakota. By Jos. Leidy, M. D.

Description of new Crinoidea and Echinoidea from the Carboniferous Rocks of the Western States, with a note on the Genus Onychaster. By F. B. Meek and A. H. Worthen.

Remarks on the Blastoidea with descriptions of new species. By F. B. Meek and A. H. Worthen.

The publication of the fifth number of the Proceedings for 1868, was announced.

April 13th.

The President, DR. HAYS, in the Chair.

Twenty-two members present.